**Response to FCC NPRM ET Docket 03-108**

I commend the Commission for its progress on trying to increasing the utility of radio spectrum. This is an area in which I have invested several years of research work at the Georgia Institute of Technology, School of Electrical and Computer Engineering, were I am a PhD candidate.

The opinions expressed in this submission are of mine alone and do not express the views of the Georgia Institute of Technology.

**Detecting Spectrum Users**

There are several challenges, which need to be addressed to facilitate transparent dynamic spectrum sharing. One major impediment to sharing spectrum is the detection of spectral users. Users of the spectrum can be divided into three basic categories: transmitters only (broadcast TV), receive only (radio astronomy, remote sensing, TV receivers), or both, transceivers (cell phones, Wi-Fi, RADAR). The location of receive-only devices is not possible without a priori knowledge of their existence. Hence protective measures need to be employed, to provide unimpeded spectral access to these vulnerable users.

The possibility of detecting spectrum users that do transmit depends on their characteristics. Broadcast transmitters including TV can be detected with relative ease because of their static location and continuous operation at a high power flux density. As the commission discussed in the NPRM, "radiometric detector" methods could be used to find such spectral users with improved sensitivity. Detection of intermittent transmitting spectral users is a far more complex. Employing the traditionally threshold detector method, to find intermittent users, results in a compromise between sensitivity and false detection rate. Even if a high false detection rate can be tolerated the sensitivity is never below the receiver noise floor.

**Radio Spectrum Engineering Lab (www.measuredspectrum.com)**

The Radio Spectrum Engineering Lab at Georgia Institute of Technology has undertaken the most extensive spectrum study and analysis ever conducted. Several studies have been performed in both urban and rural locations and covered the spectrum from 400 MHz to 7.2 GHz. This study improved on past ones by resolving spectrum usage azimuthally, in polarization, and in time. The often-dynamic nature of spectrum usage necessitates the analysis of its usage over time. To provide accurate and substantive information on spectrum usage more then five billion data samples were taken.

Attached to this submission is a presentation made by this author at 2004 International Symposium on Advanced Radio Technologies. This presentation displays spectrum usage in urban Atlanta for select unlicensed, radio location, satellite, and public safety

bands. Spectrum usage information, for the continuous frequency range from 400 MHz to 7.2 GHz, has been analyzed. Initial investigation has shown that the spectrum is being used more than anticipated. This rich data set can be used to find the portions of the spectrum that are most advantageous to share with cognitive radios.

One goal of this research work it to use the database of spectrum measurements to develop cognitive radios. A proposed cognitive radio protocol could be simulated with the spectrum study data to determine its ability to detect and avoid spectral users. This simulation tool could provide a baseline test for listen-before-talk systems discussed in paragraph 105 of the NPRM. Such a tool would determine if the sensitivity, resolution bandwidth, listen dwell time, revisit time, and response times are adequate for a cognitive radio.